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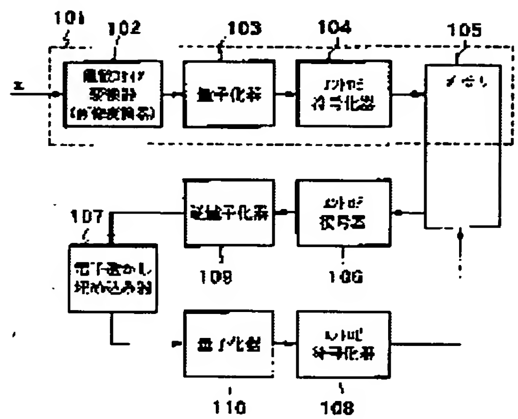
(71)Applicant : CANON INC
(72)Inventor : IWAMURA KEIICHI

(54) INFORMATION PROCESSOR/PROCESSING METHOD AND STORAGE MEDIUM

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an information processor where specified information such as electronic watermark information is buried into encoded or quantized data by installing a burying means burying specified information into data outputted from a decoding means and an encoding means quantizing and encoding again data outputted from the burying means.
SOLUTION: Compressed image data which is read from a memory 105 and is entropy-encoded is decoded by an entropy decoder 106 corresponding to an entropy encoder 104 used at the time of compression and is inputted to an electronic watermark burying unit 107. One DCT coefficient is selected from one block and a burying bit showing electronic watermark information is buried into the selected DCT coefficient. The burying of electronic watermark completes by quantizing the DCT coefficient into which the burying bit is buried. The size of a quantizing step at that time corresponds to the intensity of burying.



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CLAIMS

[Claim(s)]
[Claim 1] An information processor characterized by having a decode means which once decodes data quantized and encoded and carries out reverse quantization, an embedded means which embeds specific information to data outputted from said decode means, and a coding means to quantize again data outputted from said embedded means, and to encode.
[Claim 2] An information processor characterized by having a decode means to once decode encoded data, an embedded means which embeds specific information to data at data outputted from said decode means, and a coding means to encode again data outputted from said embedded means.
[Claim 3] An information processor characterized by having a decode means which decodes data quantized and encoded and carries out reverse quantization, and an extract means to extract specific information embedded to data outputted from said decode means.
[Claim 4] An information processor characterized by having a decode means to decode encoded data, and an extract means to extract specific information embedded to data outputted from said decode means.
[Claim 5] An information processor indicated by any of claim 1 to claim 4 characterized by said specific information being digital-watermarking information they are.
[Claim 6] Data inputted into said decode means is the information processor indicated by any of claim 1 to claim 5 characterized by being the image data to which a discrete cosine transform or wavelet transform was given they are.
[Claim 7] Said decode means is the information processor indicated by any of claim 1 to claim 6 characterized by choosing whether data inputted is decoded for every predetermined unit they are.
[Claim 8] It is the information processor which has a generation means to generate image data, a compression means to perform data compression processing to generated image data, and an embedded means that embeds specific information at image data by which the data compression was carried out, and is characterized by the ability of said compression means and said embedded means to be performed independently.
[Claim 9] An information processor indicated by claim 8 characterized by said specific information being digital-watermarking information.
[Claim 10] Actuation of said embedded means is the information processor indicated by claim 8 or claim 9 characterized by being carried out when data is outputted from said image processing system, or when said generation means is not operating.
[Claim 11] An information processing method characterized by quantizing again data with which data quantized and encoded was once decoded, reverse quantization was carried out, specific information was embedded to data by which decode and reverse quantization were carried out, and said specific information was embedded, and encoding.
[Claim 12] An information processing method characterized by encoding again data with which encoded data was once decoded, specific information was embedded to decoded data, and said specific information was embedded.
[Claim 13] An information processing method characterized by extracting specific information

which decoded data quantized and encoded, carried out reverse quantization, and was embedded to data by which reverse quantization was carried out.

[Claim 14] An information processing method characterized by extracting specific information which decoded encoded data and was embedded to decoded data.

[Claim 15] An information processing method indicated by any of claim 11 to claim 14 characterized by said specific information being digital-watermarking information they are.

[Claim 16] It is the information processing method characterized by it being the image-processing method which generates image data, performs data compression processing to generated image data, and embeds specific information at image data by which the data compression was carried out, and said compression step and said embedded step being performed independently.

[Claim 17] An information processing method indicated by claim 16 characterized by said specific information being digital-watermarking information.

[Claim 18] It is the storage characterized by to have the code of the step which quantizes again the data with which it is the storage with which the program code of the information processing which embeds specific information to data was recorded, and the code of the step which said program code once decodes the data which was quantized at least and encoded, and carries out reverse quantization, the code of the step which embeds specific information to the data by which decode and reverse quantization were carried out, and said specific information were embedded, and encodes.

[Claim 19] It is the storage characterized by to have a code of a step which is the storage with which a program code of information processing which embeds specific information to data was recorded, and encodes again a code of a step to which said program code once decodes data encoded at least, a code of a step which embeds specific information to decoded data, and data with which said specific information was embedded.

[Claim 20] It is the storage characterized by to have the code of a step which is the storage with which a program code of information processing which extracts specific information embedded to data was recorded, and extracts a code of a step which said program code decodes data which was quantized at least and encoded, and carries out reverse quantization, and specific information embedded to data by which reverse quantization was carried out.

[Claim 21] It is the storage characterized by having a code of a step from which it is the storage with which a program code of information processing which extracts specific information embedded to data was recorded, and said program code extracts a code of a step to which data with which it encoded at least is decoded, and specific information that it was embedded to data with which it decoded.

[Claim 22] It is the storage characterized by it being the storage with which a program code of an image processing which generates image data, performs data compression processing to generated image data, and embeds specific information at image data by which the data compression was carried out was recorded, and a code of said compression step and a code of said embedded step being performed independently.

[Claim 23] A storage indicated by any of claim 18 to claim 22 characterized by said specific information being digital-watermarking information they are.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to a storage at the information processor which embeds information [****] like digital-watermarking information to the data which was related with the storage, for example, was encoded or quantized by an information processor and its method, and the list and its method, and a list.
[0002]
[Description of the Prior Art] A computer in recent years and network development are remarkable, and various information, such as an alphabetic character, an image, and voice, and the so-called multimedia information are computers, and they are treated through the network. An image and audio data are that an image and audio data carry out coding compression since the amount of data is comparatively large, and processing which makes the amount of data small is performed. If image data is compressed, more image information can be transmitted to a high speed through a network. Although the common-name JPEG method which compresses the multiple-value static image in ITU-T recommendation T.81 as image compression technology has spread, aiming at compression of high performance, standardization of JPEG2000 is considered further.
[0003] Although the coding method with which JPEG uses a discrete cosine transform (DCT) is a base, JPEG2000 has the leading method which uses discrete wavelet transform. Generally, the coding equipment of JPEG and JPEG2000 consists of frequency converters 701, quantizers 702, the entropy encoders 703, etc. which perform a discrete cosine transform and discrete wavelet transform, as shown in drawing 1 A. On the other hand, the expanding equipment of JPEG and JPEG2000 consists of an entropy decoder 704, a reverse quantizer 705, a reverse frequency converter 706, etc., as shown in drawing 1 B.
[0004] By the way, since the image used in a computer or a network and voice are digitized data, it is in the environment which can reproduce those data easily, and the quality of data does not deteriorate by the duplicate, either. For this reason, in order to protect the copyright of these multimedia information, processing which embeds copyright information as digital watermarking to an image or audio data is performed. It is possible by extracting digital watermarking from multimedia data to acquire copyright information and to prevent an unjust duplicate.
[0005] As a method of embedding digital watermarking, it is the NTT method "the digital-watermarking method in the frequency domain for the protection of copyrights of a digital image" (Nakamura, a brook, Takashima, SCIS'97-26A, January, 1997) using a discrete cosine transform, for example, The National Defense Academy method "the watermark signing method to the image by PN sequence" (Onishi, **, Matsui, SCIS'97-26B, January, 1997) using discrete Fourier transform, Mitsubishi using discrete wavelet transform, the Kyushu University method "experimental consideration about the safety and reliability of the digital-watermarking technology using wavelet transform" (Ishizuka, Sakai, Sakurai, SCIS'97-26D, January, 1997), etc. are held.
[0006] Generally, these digital-watermarking embedding equipments consist of a frequency converter 801 which performs a discrete cosine transform and discrete wavelet transform, a

digital-watermarking embedding machine 802 quantized according to the information which embeds the frequency component, and a reverse frequency converter 803, as shown in drawing 2 A. On the other hand, a digital-watermarking extractor consists of a frequency converter 804 and a digital-watermarking extractor 805 which extracts the information embedded from the quantized frequency component, as shown in drawing 2 B.

[0007]

[Problem(s) to be Solved by the Invention] When performing digital-watermarking embedding processing and compression processing to image data, it is easy to compress the image data where digital watermarking was embedded. However, it is difficult to embed digital watermarking to the compressed data. Since the data by which compression processing was carried out is code data by which entropy code modulation was carried out, it is difficult data to embed digital watermarking directly at it.

[0008] Once elongating with the image inverter 907 from the entropy decoder 905 and returning the image data x compressed with the entropy encoder 904 from the image transformation machine 902 to image data as shown in drawing 3 in order to embed digital watermarking to the compressed data, digital watermarking will be embedded with the image inverter 910 from the image transformation machine 908, and the output will be further repressed with the entropy encoder 913 from the image transformation machine 911.

[0009] On the other hand, since the output of digital-watermarking embedding processing is the image data itself, it can be inputted into compression processing as it is.

[0010] However, much the applications and the equipments using coding of JPEG etc., such as equipments, such as a digital camera and color facsimile, a still picture transmission system, and a still picture processing system, are put in practical use. In these applications or equipment, using hardware, such as ASIC, it encodes first, namely, an input image is used as compressed data in many cases. Therefore, in these applications or equipment, the increase of cost great for embedding digital watermarking before compression coding will be caused.

[0011] Moreover, also in JPEG2000 under current examination, since the unification with compression coding and digital watermarking is not fully considered, a possibility that the problem that it is difficult like the case of JPEG to embed digital watermarking will arise is high.

[0012] This invention aims at offering the information processor which it is and embeds specific information like digital-watermarking information to the data encoded or quantized and its method for solving an above-mentioned problem.

[0013]

[Means for Solving the Problem] This invention is equipped with the following configurations as a way stage which attains the aforementioned purpose.

[0014] An information processor concerning this invention is characterized by to have a decode means which once decodes data quantized and encoded and carries out reverse quantization, an embedded means which embeds specific information to data outputted from said decode means, and a coding means quantize again data outputted from said embedded means, and encode.

[0015] Moreover, it is characterized by having a decode means to once decode encoded data, an embedded means which embeds specific information to data at data outputted from said decode means, and a coding means to encode again data outputted from said embedded means.

[0016] Moreover, it is characterized by having a decode means which decodes data quantized and encoded and carries out reverse quantization, and an extract means to extract specific information embedded to data outputted from said decode means.

[0017] Moreover, it is characterized by having a decode means to decode encoded data, and an extract means to extract specific information embedded to data outputted from said decode means.

[0018] An information processing method concerning this invention is characterized by quantizing again data with which data quantized and encoded was once decoded, reverse quantization was carried out, specific information was embedded to data by which decode and reverse quantization were carried out, and said specific information was embedded, and encoding.

[0019] Moreover, it is characterized by encoding again data with which encoded data was once

decoded, specific information was embedded to decoded data, and said specific information was embedded.
[0020] Moreover, it is characterized by extracting specific information which decoded data quantized and encoded, carried out reverse quantization, and was embedded to data by which reverse quantization was carried out.
[0021] Moreover, it is characterized by extracting specific information which decoded encoded data and was embedded to decoded data.
[0022]
[Embodiment of the Invention] Hereafter, the image processing system which is an information processor of 1 operation gestalt concerning this invention is explained to details with reference to a drawing. In addition, this invention relates to the information processor which performs protection of copyright, alteration prevention of an image, various information records, etc., and its method by performing compression processing and embedding processing of digital watermarking to digital image data.
[0023]
[The 1st operation gestalt] Drawing 4 is the block diagram showing the outline configuration of the image processing system of the 1st operation gestalt. First, the flow of processing is explained briefly.
[0024] In drawing 4, the image data x inputted is multiple-value image data which has the predetermined number of bits per pixel. Predetermined transform processing is performed to the multiple-value image data inputted with the discrete cosine transform vessel 102, and it is decomposed into a predetermined frequency component. The pixel of input image data is decomposed into the block which does not lap mutually, and a discrete cosine transform is performed in the block unit. A discrete cosine transform can be performed using a degree type. Xi (u, v) -- = -- two -- /-- N-C -- (-- u --) -- C -- (-- v --) -- sigmausigma -- vxi (m, n) - cos -- [-- {(2m+1) -- u -- pi --} -- /(2Ns) --] - cos -- [-- {(2n+1) -- v -- pi --} -- /(2Ns) --] -- -- It is C (p) at the time of (1), however p = 0. Time [of = 1/root2p !=0] c (p) = 1 [0025] Since the image data of a natural image includes many signals of a low-frequency component, it can bias a signal toward a low frequency field by giving a discrete cosine transform. The transform coefficient (it is called a "DCT coefficient" below) outputted from the discrete cosine transform machine 102 is inputted into a quantizer 103.
[0026] As mentioned above, since the image data of a natural image includes many signals of a low-frequency component, if many bits are assigned by the low-frequency component of image data and few bits are assigned by the high frequency component, it can compress image data efficiently by quantization.
[0027] The quantized image data is inputted into the entropy encoder 104 which performs Huffman coding etc., and a symbolic language with a long symbolic language short to the high information on appearance probability is assigned to the low information on appearance probability, consequently average symbolic-language length is shortened. The compression image data by which entropy code modulation was carried out is inputted into the memory 105, such as magnetic storage.
[0028] Below, the processing which embeds digital watermarking at the compression image data memorized by memory 105 is explained.
[0029] The compression image data by which reading appearance was carried out from memory 105 and by which entropy code modulation was carried out is decoded with the entropy decoder 106 corresponding to the entropy encoder 104 used at the time of compression, and quantization data is obtained. Reverse quantization is carried out with the reverse quantizer 109 corresponding to the quantizer 103 used at the time of compression, and this quantization data is returned to a DCT coefficient. And digital watermarking is embedded for a DCT coefficient with the digital-watermarking embedding vessel 107. That is, the digital-watermarking embedding machine 107 outputs the DCT coefficient where digital watermarking was embedded by operating a DCT coefficient.
[0030] Compression processing of the DCT coefficient where digital watermarking was embedded is again carried out with a quantizer 110 and the entropy encoder 108, and the output of the

entropy encoder 108 is again memorized by memory 105.
[0031] The following methods are held to the embedding method of digital watermarking using a discrete cosine transform.
[0032] An input image is divided into a 8x8-pixel square block, and the DCT coefficient obtained by the discrete cosine transform is inputted into the digital-watermarking embedding machine 107. And one DCT coefficient is chosen from one blocks, and the bit (it is called an "embedded bit" below) showing digital-watermarking information is embedded for the selected DCT coefficient. In addition, the frequency component which embeds an embedded bit is chosen from the component of the comparison-low frequency except a dc component at random.
[0033] And the embedding of digital watermarking is completed by quantizing the DCT coefficient where the embedded bit was embedded. The magnitude of a quantization step at this time is equivalent to embedded reinforcement.
[0034] The example which embeds the bit (it is called an "embedding bit" below) '0' for embedding digital watermarking or '1' is shown below. First, the value q which quantized s_ {u_0 v_0} by the formula (2) is acquired.
q = <<s_ {u_0 v_0}/h >> h -- For the value h of a DCT coefficient, s_ {u_0 v_0} is [embedding on-the-strength < <x>>] (2), however the maximum integer which does not exceed x. [0035] And c nearest to s_ {u_0 v_0} is made into the DCT coefficient after digital-watermarking embedding among c obtained from a formula (3) or a formula (4).
At the time of an embedded bit '0' c = q+ht+q/4 -- At the time of (3) embedded bit '1' c = q+ht+3q/4 -- (4), however t are the natural number. [0036] In the above-mentioned example of digital-watermarking embedding, the initial value set to the random number generator which generates the random digits for specifying an embedding component, and the value of a quantization step become a key.
[0037] Although the equipment with which from compression processing of image data to embedding processing of digital watermarking was unified was explained above, the processing from the discrete cosine transform machine 102 to memory 105 is usually unified as picture compression equipment 101 in many cases. Therefore, when embedding digital watermarking at the compression image data memorized by memory 105, processing by the entropy encoder 110 is only added from the entropy decoder 106 shown in drawing 4, embedding processing of digital watermarking is realized, and it is efficient.
[0038] Moreover, when performing compression processing of image data, and embedding processing of digital watermarking to continuation, compression image data can also be inputted into the direct entropy decoder 106, without inputting into memory 105. Moreover, it is also ****** to consider the output of the entropy encoder 108 as the output of an image processing system 101, without inputting into memory 105.
[0039] Moreover, since embedding processing of digital watermarking can be performed independently of compression processing of image data when using memory 105, in case compression image data is outputted from an image processing system, embedding processing of digital watermarking is performed, or a usage, such as carrying out, when compression processing of image data is not performed (i.e., when image data x is not inputted), can be considered.
[0040] Furthermore, what is necessary is just to control memory 105 so that compression image data is not outputted to the entropy decoder 106 from memory 105 when you do not need the embedding of digital watermarking.
[0041]
[The 2nd operation gestalt] Hereafter, the image processing system of the 2nd operation gestalt concerning this invention is explained. In addition, in this operation gestalt, about the same configuration as the 1st operation gestalt and abbreviation, the same sign is attached and the detailed explanation is omitted.
[0042] Technique to embed digital watermarking explained in the 1st operation gestalt quantizes DCT coefficient s_ {u_0 v_0} with Parameter h in < <s_{u_0v_0} >> of a formula (2). Since this quantization differs from the quantization in data compression processing, it needs to return compression image data to a DCT coefficient in the 1st operation gestalt using the entropy decoder 106 and the reverse quantizer 109.

[0043] Here, the quantization used for embedding processing of digital watermarking is the same as the quantization used by data compression processing, or when it is processing in consideration of the quantization used by data compression processing, digital watermarking can be embedded to quantization data, without needing the reverse quantizer 109.
[0044] Drawing 5 is the block diagram showing the example of a configuration of the image processing system which does not need the reverse quantizer 109.
[0045] For example, if the parameter h in a formula (2) is made the same as the value of the quantization step used by the data compression, since the quantization data by which entropy decode was carried out is equivalent to < <s_ {u_0 v_0}/h >>, it is clear that its q of a formula (2) can be calculated using it and digital watermarking can be embedded.
[0046] The case where the quantization used for data compression processing and embedding processing of digital watermarking was the same above was explained. When the quantization used for embedding processing of digital watermarking is, on the other hand, taking into consideration the quantization used for compression processing (i.e., when the value of two quantization steps has a certain relation), the quantization data by which entropy decode was carried out can be changed into complement child-ized data at embedding processing of digital watermarking. Therefore, also when the quantization used for embedding processing of digital watermarking is taking into consideration the quantization used for compression processing, as shown in drawing 2, it is clear that digital watermarking can be embedded without the reverse quantizer 109 at compression image data.
[0047]
[The 3rd operation gestalt] Hereafter, the image processing system of the 3rd operation gestalt concerning this invention is explained. In addition, in this operation gestalt, about the same configuration as the 1st operation gestalt and abbreviation, the same sign is attached and the detailed explanation is omitted.
[0048] In an above-mentioned operation gestalt, although the embedding of digital watermarking using a discrete cosine transform was explained, this invention can embed digital watermarking using various image transformation other than a discrete cosine transform. For example, although discrete wavelet transform is leading as image transformation, since overall compression/expanding procedure is due to be performed with the configuration shown in drawing 1 A and 1B, this invention is effective in JPEG2000, also to JPEG2000. Although the various conversion which includes discrete Fourier transform and predicting coding further is mentioned as other image transformation, when the data compression of those translation data is carried out by quantization and entropy code modulation, embedding processing of digital watermarking by this invention is effective.
[0049] Moreover, when using the same image transformation by not only the example of embedding of digital watermarking shown in the 1st and 2nd operation gestalt but the data compression, and the embedding of digital watermarking, technique to embed versatility can use with the digital-watermarking embedding vessel 107.
[0050] Moreover, although the 1st and 2nd operation gestalt explained the object which embeds digital watermarking as image data, this invention can be applied, not only image data but when performing various data compressions to the sound data containing voice etc. and embedding digital watermarking to it.
[0051] Moreover, as shown in drawing 6 A and drawing 6 B, the embedding block of digital watermarking shown in the 1st and 2nd operation gestalt can be made to be able to become independent, and can also be used as equipment.
[0052] As shown in drawing 7, a switch 111 can be formed in front of a quantizer 103, and the DCT coefficient inputted into a quantizer 103 can also be chosen from which output of the image transformation machine 102 or the digital-watermarking embedding machine 107. If it does in this way, in the 1st and 2nd operation gestalt, it is possible to share the entropy encoder 104 and a quantizer 103 between compression processing of image data and embedding processing of digital watermarking, and still more efficient equipment can be realized.
[0053] Moreover, it sets to an image processing system equipped with a picture compression block and an image expanding block. By leading the output of the reverse quantizer 109 for

image expanding to the digital-watermarking embedding machine 107, and forming a switch 111 in front of a quantizer 103 further, as shown in drawing 8 It is possible to share the entropy encoder 104 and not only the quantizer 103 but the entropy decoder 106 and the reverse quantizer 109 for expanding processing between embedding processing of digital watermarking, and still more efficient equipment can be realized. In addition, the image inverter 112 performs processing of the image transformation machine 102 and reverse.

[0054]

[The 4th operation gestalt] Hereafter, the image processing system of the 4th operation gestalt concerning this invention is explained. In addition, in this operation gestalt, about the same configuration as each above-mentioned operation gestalt and abbreviation, the same sign is attached and the detailed explanation is omitted.

[0055] Drawing 9 and drawing 10 are the block diagrams showing the example of a configuration of the equipment which extracts digital watermarking from the compressed data with which digital watermarking was embedded, and the example of a configuration corresponding to the embedding equipment of digital watermarking which shows drawing 9 to drawing 6 A, and drawing 10 are examples of a configuration which do not need the reverse quantizer corresponding to the embedding equipment of digital watermarking shown in drawing 6 B.

[0056] The data inputted into the equipment shown in drawing 9 and drawing 10 is the compressed data with which digital watermarking was embedded. The compressed data inputted is changed into quantization data by the entropy decoder 501 corresponding to the entropy encoder 108 used for the embedding of digital watermarking. With the configuration shown in drawing 9, after the obtained quantization data is changed into the coefficient for which it depends on the image transformation methods, such as a DCT coefficient, with the reverse quantizer 502 corresponding to the quantizer 110 used for the embedding of digital watermarking, it is inputted into the digital-watermarking extractor 503. Quantization data is inputted into the digital-watermarking extractor 503 with the configuration shown in drawing 10.

[0057] The digital-watermarking extractor 503 extracts the digital-watermarking information embedded by the extract processing corresponding to the embedding of digital watermarking. Extract processing of this digital watermarking should just be the technique corresponding to embedding processing of digital watermarking using the discrete cosine transform explained with the 1st and 2nd operation gestalt, and embedding processing of digital watermarking using the various image transformation explained with the 3rd operation gestalt.

[0058] The image processing system of each operation gestalt mentioned above is applicable to a picture input device like a digital camera. In that case, though picture compression processing in these picture input devices is hardware-ized, if digital-watermarking embedding processing is realized by supplying a program to CPU, digital-watermarking embedding processing can be realized easily, without adding new hardware. Furthermore, since a real-time operation is not necessarily required of digital-watermarking embedding processing unlike data compression processing, when transmitting data to a personal computer etc. from picture input devices, such as a digital camera, or while the picture input device is not performing the image input, it can perform embedding processing of digital watermarking. Then, even when the throughput of CPU carried in the picture input device is small, it is possible to perform embedding of digital watermarking for a short time.

[0059] Moreover, the image processing system of each operation gestalt mentioned above applicable also to an image I/O device like color facsimile equipment is clear. In that case, when digital watermarking embedded by the picture input device includes the digital-watermarking extract function shown in the 4th operation gestalt in an image output unit, the embedded digital-watermarking information is extracted. Under the present circumstances, when the regulation information over an image output is shown by the embedded digital-watermarking information, it is also possible to control an image output unit according to that regulation information.

[0060] Moreover, each operation gestalt applicable to many systems, such as a still picture transmission system, a still picture processing system, etc. with compression applications, such as JPEG, mentioned above is clear.

[0061] As explained above, according to each operation gestalt mentioned above, by adding the easy processing means for the image processing system which has a picture compression function, digital-watermarking information can be embedded to the compressed data, and digital-watermarking information can be extracted.

[0062]

[Other operation gestalten] In addition, even if it applies this invention to the system which consists of two or more devices (for example, a host computer, an interface device, a reader, a printer, etc.), it may be applied to the equipments (for example, a copying machine, facsimile apparatus, etc.) which consist of one device.

[0063] Moreover, it cannot be overemphasized by the purpose of this invention supplying the storage which recorded the program code of the software which realizes the function of the operation gestalt mentioned above to a system or equipment, and carrying out read-out activation of the program code with which the computer (or CPU and MPU) of the system or equipment was stored in the storage that it is attained. In this case, the function of the operation gestalt which the program code itself read from the storage mentioned above will be realized, and the storage which memorized that program code will constitute this invention. Moreover, it cannot be overemphasized that it is contained also when the function of the operation gestalt which performed a part or all of processing that OS (operating system) which is working on a computer is actual, based on directions of the program code, and the function of the operation gestalt mentioned above by performing the program code which the computer read is not only realized, but was mentioned above by the processing is realized.

[0064] Furthermore, after the program code read from a storage is written in the memory with which the functional expansion unit connected to the functional expansion card inserted in the computer or a computer is equipped, it cannot be overemphasized that it is contained also when the function of the operation gestalt which performed a part or all of processing that CPU with which the functional expansion card and functional expansion unit are equipped based on directions of the program code is actual, and mentioned above by the processing is realized.

[0065]

[Effect of the Invention] As explained above, according to this invention, the information processor which embeds specific information like digital-watermarking information to the data encoded or quantized, and its method can be offered.

[Translation done.]

TECHNICAL FIELD

[The technical field to which invention belongs] This invention relates to a storage at the information processor which embeds information [****] like digital-watermarking information to the data which was related with the storage, for example, was encoded or quantized by an information processor and its method, and the list and its method, and a list.

[Translation done.]

PRIOR ART

[Description of the Prior Art] A computer in recent years and network development are remarkable, and various information, such as an alphabetic character, an image, and voice, and the so-called multimedia information are computers, and they are treated through the network. An image and audio data are that an image and audio data carry out coding compression since the amount of data is comparatively large, and processing which makes the amount of data small is performed. If image data is compressed, more image information can be transmitted to a high speed through a network. Although the common-name JPEG method which compresses the multiple-value static image in ITU-T recommendation T.81 as image compression technology has spread, aiming at compression of high performance, standardization of JPEG2000 is considered further.
[0003] Although the coding method with which JPEG uses a discrete cosine transform (DCT) is a base, JPEG2000 has the leading method which uses discrete wavelet transform. Generally, the coding equipment of JPEG and JPEG2000 consists of frequency converters 701, quantizers 702, the entropy encoders 703, etc. which perform a discrete cosine transform and discrete wavelet transform, as shown in drawing 1 A. On the other hand, the expanding equipment of JPEG and JPEG2000 consists of an entropy decoder 704, a reverse quantizer 705, a reverse frequency converter 706, etc., as shown in drawing 1 B.
[0004] By the way, since the image used in a computer or a network and voice are digitized data, it is in the environment which can reproduce those data easily, and the quality of data does not deteriorate by the duplicate, either. For this reason, in order to protect the copyright of these multimedia information, processing which embeds copyright information as digital watermarking to an image or audio data is performed. It is possible by extracting digital watermarking from multimedia data to acquire copyright information and to prevent an unjust duplicate.
[0005] As a method of embedding digital watermarking, it is the NTT method "the digital-watermarking method in the frequency domain for the protection of copyrights of a digital image" (Nakamura, a brook, Takashima, SCIS'97-26A, January, 1997) using a discrete cosine transform, for example, The National Defense Academy method "the watermark signing method to the image by PN sequence" (Onishi, **, Matsui, SCIS'97-26B, January, 1997) using discrete Fourier transform, Mitsubishi using discrete wavelet transform, the Kyushu University method "experimental consideration about the safety and reliability of the digital-watermarking technology using wavelet transform" (Ishizuka, Sakai, Sakurai, SCIS'97-26D, January, 1997), etc. are held.
[0006] Generally, these digital-watermarking embedding equipments consist of a frequency converter 801 which performs a discrete cosine transform and discrete wavelet transform, a digital-watermarking embedding machine 802 quantized according to the information which embeds the frequency component, and a reverse frequency converter 803, as shown in drawing 2 A. On the other hand, a digital-watermarking extractor consists of a frequency converter 804 and a digital-watermarking extractor 805 which extracts the information embedded from the quantized frequency component, as shown in drawing 2 B.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to this invention, the information processor which embeds specific information like digital-watermarking information to the data encoded or quantized, and its method can be offered.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] When performing digital-watermarking embedding processing and compression processing to image data, it is easy to compress the image data where digital watermarking was embedded. However, it is difficult to embed digital watermarking to the compressed data. Since the data by which compression processing was carried out is code data by which entropy code modulation was carried out, it is difficult data to embed digital watermarking directly at it.
[0008] Once elongating with the image inverter 907 from the entropy decoder 905 and returning the image data x compressed with the entropy encoder 904 from the image transformation machine 902 to image data as shown in drawing 3 in order to embed digital watermarking to the compressed data, digital watermarking will be embedded with the image inverter 910 from the image transformation machine 908, and the output will be further repressed with the entropy encoder 913 from the image transformation machine 911.
[0009] On the other hand, since the output of digital-watermarking embedding processing is the image data itself, it can be inputted into compression processing as it is.
[0010] However, much the applications and the equipments using coding of JPEG etc., such as equipments, such as a digital camera and color facsimile, a still picture transmission system, and a still picture processing system, are put in practical use. In these applications or equipment, using hardware, such as ASIC, it encodes first, namely, an input image is used as compressed data in many cases. Therefore, in these applications or equipment, the increase of cost great for embedding digital watermarking before compression coding will be caused.
[0011] Moreover, also in JPEG2000 under current examination, since the unification with compression coding and digital watermarking is not fully considered, a possibility that the problem that it is difficult like the case of JPEG to embed digital watermarking will arise is high.
[0012] This invention aims at offering the information processor which it is and embeds specific information like digital-watermarking information to the data encoded or quantized and its method for solving an above-mentioned problem.

[Translation done.]

MEANS

[Means for Solving the Problem] This invention is equipped with the following configurations as a way stage which attains the aforementioned purpose.
[0014] An information processor concerning this invention is characterized by to have a decode means which once decodes data quantized and encoded and carries out reverse quantization, an embedded means which embeds specific information to data outputted from said decode means, and a coding means quantize again data outputted from said embedded means, and encode.
[0015] Moreover, it is characterized by having a decode means to once decode encoded data, an embedded means which embeds specific information to data at data outputted from said decode means, and a coding means to encode again data outputted from said embedded means.
[0016] Moreover, it is characterized by having a decode means which decodes data quantized and encoded and carries out reverse quantization, and an extract means to extract specific information embedded to data outputted from said decode means.
[0017] Moreover, it is characterized by having a decode means to decode encoded data, and an extract means to extract specific information embedded to data outputted from said decode means.
[0018] An information processing method concerning this invention is characterized by quantizing again data with which data quantized and encoded was once decoded, reverse quantization was carried out, specific information was embedded to data by which decode and reverse quantization were carried out, and said specific information was embedded, and encoding.
[0019] Moreover, it is characterized by encoding again data with which encoded data was once decoded, specific information was embedded to decoded data, and said specific information was embedded.
[0020] Moreover, it is characterized by extracting specific information which decoded data quantized and encoded, carried out reverse quantization, and was embedded to data by which reverse quantization was carried out.
[0021] Moreover, it is characterized by extracting specific information which decoded encoded data and was embedded to decoded data.
[0022]
[Embodiment of the Invention] Hereafter, the image processing system which is an information processor of 1 operation gestalt concerning this invention is explained to details with reference to a drawing. In addition, this invention relates to the information processor which performs protection of copyright, alteration prevention of an image, various information records, etc., and its method by performing compression processing and embedding processing of digital watermarking to digital image data.
[0023]
[The 1st operation gestalt] Drawing 4 is the block diagram showing the outline configuration of the image processing system of the 1st operation gestalt. First, the flow of processing is explained briefly.
[0024] In drawing 4, the image data x inputted is multiple-value image data which has the predetermined number of bits per pixel. Predetermined transform processing is performed to the

multiple-value image data inputted with the discrete cosine transform vessel 102, and it is decomposed into a predetermined frequency component. The pixel of input image data is decomposed into the block which does not lap mutually, and a discrete cosine transform is performed in the block unit. A discrete cosine transform can be performed using a degree type. Xi (u, v) -- = -- two -- /-- N-C -- (-- u --) -- C -- (-- v --) -- sigmausigma -- vxi (m, n) - cos -- [-- {(2m+1) -- u -- pi --} -- /(2Ns) --] - cos -- [-- {(2n+1) -- v -- pi --} -- /(2Ns) --] -- -- It is C (p) at the time of (1), however p = 0. Time [of = 1/root2p !=0] c (p) = 1 [0025] Since the image data of a natural image includes many signals of a low-frequency component, it can bias a signal toward a low frequency field by giving a discrete cosine transform. The transform coefficient (it is called a "DCT coefficient" below) outputted from the discrete cosine transform machine 102 is inputted into a quantizer 103.

[0026] As mentioned above, since the image data of a natural image includes many signals of a low-frequency component, if many bits are assigned by the low-frequency component of image data and few bits are assigned by the high frequency component, it can compress image data efficiently by quantization.

[0027] The quantized image data is inputted into the entropy encoder 104 which performs Huffman coding etc., and a symbolic language with a long symbolic language short to the high information on appearance probability is assigned to the low information on appearance probability, consequently average symbolic-language length is shortened. The compression image data by which entropy code modulation was carried out is inputted into the memory 105, such as magnetic storage.

[0028] Below, the processing which embeds digital watermarking at the compression image data memorized by memory 105 is explained.

[0029] The compression image data by which reading appearance was carried out from memory 105 and by which entropy code modulation was carried out is decoded with the entropy decoder 106 corresponding to the entropy encoder 104 used at the time of compression, and quantization data is obtained. Reverse quantization is carried out with the reverse quantizer 109 corresponding to the quantizer 103 used at the time of compression, and this quantization data is returned to a DCT coefficient. And digital watermarking is embedded for a DCT coefficient with the digital-watermarking embedding vessel 107. That is, the digital-watermarking embedding machine 107 outputs the DCT coefficient where digital watermarking was embedded by operating a DCT coefficient.

[0030] Compression processing of the DCT coefficient where digital watermarking was embedded is again carried out with a quantizer 110 and the entropy encoder 108, and the output of the entropy encoder 108 is again memorized by memory 105.

[0031] The following methods are held to the embedding method of digital watermarking using a discrete cosine transform.

[0032] An input image is divided into a 8x8-pixel square block, and the DCT coefficient obtained by the discrete cosine transform is inputted into the digital-watermarking embedding machine 107. And one DCT coefficient is chosen from one blocks, and the bit (it is called an "embedded bit" below) showing digital-watermarking information is embedded for the selected DCT coefficient. In addition, the frequency component which embeds an embedded bit is chosen from the component of the comparison-low frequency except a dc component at random.

[0033] And the embedding of digital watermarking is completed by quantizing the DCT coefficient where the embedded bit was embedded. The magnitude of a quantization step at this time is equivalent to embedded reinforcement.

[0034] The example which embeds the bit (it is called an "embedding bit" below) '0' for embedding digital watermarking or '1' is shown below. First, the value q which quantized s_ {u_0 v_0} by the formula (2) is acquired.

q = <<s_ {u_0 v_0}/h >> h -- For the value h of a DCT coefficient, s_ {u_0 v_0} is [embedding on-the-strength < <x>>] (2), however the maximum integer which does not exceed x. [0035] And c nearest to s_ {u_0 v_0} is made into the DCT coefficient after digital-watermarking embedding among c obtained from a formula (3) or a formula (4).

At the time of an embedded bit '0' c = q+ht+q/4 -- At the time of (3) embedded bit '1' c =

q+ht+3q/4 -- (4), however t are the natural number. [0036] In the above-mentioned example of digital-watermarking embedding, the initial value set to the random number generator which generates the random digits for specifying an embedding component, and the value of a quantization step become a key.
[0037] Although the equipment with which from compression processing of image data to embedding processing of digital watermarking was unified was explained above, the processing from the discrete cosine transform machine 102 to memory 105 is usually unified as picture compression equipment 101 in many cases. Therefore, when embedding digital watermarking at the compression image data memorized by memory 105, processing by the entropy encoder 110 is only added from the entropy decoder 106 shown in drawing 4, embedding processing of digital watermarking is realized, and it is efficient.
[0038] Moreover, when performing compression processing of image data, and embedding processing of digital watermarking to continuation, compression image data can also be inputted into the direct entropy decoder 106, without inputting into memory 105. Moreover, it is also ****** to consider the output of the entropy encoder 108 as the output of an image processing system 101, without inputting into memory 105.
[0039] Moreover, since embedding processing of digital watermarking can be performed independently of compression processing of image data when using memory 105, in case compression image data is outputted from an image processing system, embedding processing of digital watermarking is performed, or a usage, such as carrying out, when compression processing of image data is not performed (i.e., when image data x is not inputted), can be considered.
[0040] Furthermore, what is necessary is just to control memory 105 so that compression image data is not outputted to the entropy decoder 106 from memory 105 when you do not need the embedding of digital watermarking.
[0041]
[The 2nd operation gestalt] Hereafter, the image processing system of the 2nd operation gestalt concerning this invention is explained. In addition, in this operation gestalt, about the same configuration as the 1st operation gestalt and abbreviation, the same sign is attached and the detailed explanation is omitted.
[0042] Technique to embed digital watermarking explained in the 1st operation gestalt quantizes DCT coefficient s_ {u_0 v_0} with Parameter h in < <s_{u_0v_0} >> of a formula (2). Since this quantization differs from the quantization in data compression processing, it needs to return compression image data to a DCT coefficient in the 1st operation gestalt using the entropy decoder 106 and the reverse quantizer 109.
[0043] Here, the quantization used for embedding processing of digital watermarking is the same as the quantization used by data compression processing, or when it is processing in consideration of the quantization used by data compression processing, digital watermarking can be embedded to quantization data, without needing the reverse quantizer 109.
[0044] Drawing 5 is the block diagram showing the example of a configuration of the image processing system which does not need the reverse quantizer 109.
[0045] For example, if the parameter h in a formula (2) is made the same as the value of the quantization step used by the data compression, since the quantization data by which entropy decode was carried out is equivalent to < <s_ {u_0 v_0}/h >>, it is clear that its q of a formula (2) can be calculated using it and digital watermarking can be embedded.
[0046] The case where the quantization used for data compression processing and embedding processing of digital watermarking was the same above was explained. When the quantization used for embedding processing of digital watermarking is, on the other hand, taking into consideration the quantization used for compression processing (i.e., when the value of two quantization steps has a certain relation), the quantization data by which entropy decode was carried out can be changed into complement child-ized data at embedding processing of digital watermarking. Therefore, also when the quantization used for embedding processing of digital watermarking is taking into consideration the quantization used for compression processing, as shown in drawing 2, it is clear that digital watermarking can be embedded without the reverse quantizer 109 at compression image data.

[0047]
[The 3rd operation gestalt] Hereafter, the image processing system of the 3rd operation gestalt concerning this invention is explained. In addition, in this operation gestalt, about the same configuration as the 1st operation gestalt and abbreviation, the same sign is attached and the detailed explanation is omitted.
[0048] In an above-mentioned operation gestalt, although the embedding of digital watermarking using a discrete cosine transform was explained, this invention can embed digital watermarking using various image transformation other than a discrete cosine transform. For example, although discrete wavelet transform is leading as image transformation, since overall compression/expanding procedure is due to be performed with the configuration shown in drawing 1 A and 1B, this invention is effective in JPEG2000, also to JPEG2000. Although the various conversion which includes discrete Fourier transform and predicting coding further is mentioned as other image transformation, when the data compression of those translation data is carried out by quantization and entropy code modulation, embedding processing of digital watermarking by this invention is effective.
[0049] Moreover, when using the same image transformation by not only the example of embedding of digital watermarking shown in the 1st and 2nd operation gestalt but the data compression, and the embedding of digital watermarking, technique to embed versatility can use with the digital-watermarking embedding vessel 107.
[0050] Moreover, although the 1st and 2nd operation gestalt explained the object which embeds digital watermarking as image data, this invention can be applied, not only image data but when performing various data compressions to the sound data containing voice etc. and embedding digital watermarking to it.
[0051] Moreover, as shown in drawing 6 A and drawing 6 B, the embedding block of digital watermarking shown in the 1st and 2nd operation gestalt can be made to be able to become independent, and can also be used as equipment.
[0052] As shown in drawing 7, a switch 111 can be formed in front of a quantizer 103, and the DCT coefficient inputted into a quantizer 103 can also be chosen from which output of the image transformation machine 102 or the digital-watermarking embedding machine 107. If it does in this way, in the 1st and 2nd operation gestalt, it is possible to share the entropy encoder 104 and a quantizer 103 between compression processing of image data and embedding processing of digital watermarking, and still more efficient equipment can be realized.
[0053] Moreover, it sets to an image processing system equipped with a picture compression block and an image expanding block. By leading the output of the reverse quantizer 109 for image expanding to the digital-watermarking embedding machine 107, and forming a switch 111 in front of a quantizer 103 further, as shown in drawing 8 It is possible to share the entropy encoder 104 and not only the quantizer 103 but the entropy decoder 106 and the reverse quantizer 109 for expanding processing between embedding processing of digital watermarking, and still more efficient equipment can be realized. In addition, the image inverter 112 performs processing of the image transformation machine 102 and reverse.
[0054]
[The 4th operation gestalt] Hereafter, the image processing system of the 4th operation gestalt concerning this invention is explained. In addition, in this operation gestalt, about the same configuration as each above-mentioned operation gestalt and abbreviation, the same sign is attached and the detailed explanation is omitted.
[0055] Drawing 9 and drawing 10 are the block diagrams showing the example of a configuration of the equipment which extracts digital watermarking from the compressed data with which digital watermarking was embedded, and the example of a configuration corresponding to the embedding equipment of digital watermarking which shows drawing 9 to drawing 6 A, and drawing 10 are examples of a configuration which do not need the reverse quantizer corresponding to the embedding equipment of digital watermarking shown in drawing 6 B.
[0056] The data inputted into the equipment shown in drawing 9 and drawing 10 is the compressed data with which digital watermarking was embedded. The compressed data inputted is changed into quantization data by the entropy decoder 501 corresponding to the entropy

encoder 108 used for the embedding of digital watermarking. With the configuration shown in drawing 9, after the obtained quantization data is changed into the coefficient for which it depends on the image transformation methods, such as a DCT coefficient, with the reverse quantizer 502 corresponding to the quantizer 110 used for the embedding of digital watermarking, it is inputted into the digital-watermarking extractor 503. Quantization data is inputted into the digital-watermarking extractor 503 with the configuration shown in drawing 10.
[0057] The digital-watermarking extractor 503 extracts the digital-watermarking information embedded by the extract processing corresponding to the embedding of digital watermarking. Extract processing of this digital watermarking should just be the technique corresponding to embedding processing of digital watermarking using the discrete cosine transform explained with the 1st and 2nd operation gestalt, and embedding processing of digital watermarking using the various image transformation explained with the 3rd operation gestalt.
[0058] The image processing system of each operation gestalt mentioned above is applicable to a picture input device like a digital camera. In that case, though picture compression processing in these picture input devices is hardware-ized, if digital-watermarking embedding processing is realized by supplying a program to CPU, digital-watermarking embedding processing can be realized easily, without adding new hardware. Furthermore, since a real-time operation is not necessarily required of digital-watermarking embedding processing unlike data compression processing, when transmitting data to a personal computer etc. from picture input devices, such as a digital camera, or while the picture input device is not performing the image input, it can perform embedding processing of digital watermarking. Then, even when the throughput of CPU carried in the picture input device is small, it is possible to perform embedding of digital watermarking for a short time.
[0059] Moreover, the image processing system of each operation gestalt mentioned above applicable also to an image I/O device like color facsimile equipment is clear. In that case, when digital watermarking embedded by the picture input device includes the digital-watermarking extract function shown in the 4th operation gestalt in an image output unit, the embedded digital-watermarking information is extracted. Under the present circumstances, when the regulation information over an image output is shown by the embedded digital-watermarking information, it is also possible to control an image output unit according to that regulation information.
[0060] Moreover, each operation gestalt applicable to many systems, such as a still picture transmission system, a still picture processing system, etc. with compression applications, such as JPEG, mentioned above is clear.
[0061] As explained above, according to each operation gestalt mentioned above, by adding the easy processing means for the image processing system which has a picture compression function, digital-watermarking information can be embedded to the compressed data, and digital-watermarking information can be extracted.
[0062]
[Other operation gestalten] In addition, even if it applies this invention to the system which consists of two or more devices (for example, a host computer, an interface device, a reader, a printer, etc.), it may be applied to the equipments (for example, a copying machine, facsimile apparatus, etc.) which consist of one device.
[0063] Moreover, it cannot be overemphasized by the purpose of this invention supplying the storage which recorded the program code of the software which realizes the function of the operation gestalt mentioned above to a system or equipment, and carrying out read-out activation of the program code with which the computer (or CPU and MPU) of the system or equipment was stored in the storage that it is attained. In this case, the function of the operation gestalt which the program code itself read from the storage mentioned above will be realized, and the storage which memorized that program code will constitute this invention. Moreover, it cannot be overemphasized that it is contained also when the function of the operation gestalt which performed a part or all of processing that OS (operating system) which is working on a computer is actual, based on directions of the program code, and the function of the operation gestalt mentioned above by performing the program code which the computer read

is not only realized, but was mentioned above by the processing is realized.
[0064] Furthermore, after the program code read from a storage is written in the memory with which the functional expansion unit connected to the functional expansion card inserted in the computer or a computer is equipped, it cannot be overemphasized that it is contained also when the function of the operation gestalt which performed a part or all of processing that CPU with which the functional expansion card and functional expansion unit are equipped based on directions of the program code is actual, and mentioned above by the processing is realized.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1 A] The block diagram explaining the outline of image coding equipment,
[Drawing 1 B] The block diagram explaining the outline of image decode equipment,
[Drawing 2 A] The block diagram explaining the outline of digital-watermarking embedding equipment,
[Drawing 2 B] The block diagram explaining the outline of a digital-watermarking extractor,
[Drawing 3] The block diagram explaining the outline of the equipment which embeds digital watermarking at compressed data,
[Drawing 4] The block diagram showing the example of a configuration of the image processing system of the 1st operation gestalt,
[Drawing 5] The block diagram showing the example of a configuration of the image processing system of the 2nd operation gestalt,
[Drawing 6 A] The block diagram showing the example of a configuration of the image processing system of the 3rd operation gestalt,
[Drawing 6 B] The block diagram showing the second example of the image processing system of the 3rd operation gestalt,
[Drawing 7] The block diagram showing the third example of the image processing system of the 3rd operation gestalt,
[Drawing 8] The block diagram showing the fourth example of the image processing system of the 3rd operation gestalt,
[Drawing 9] The block diagram showing the example of a configuration of the image processing system of the 4th operation gestalt,
[Drawing 10] It is the block diagram showing the second example of the image processing system of the 4th operation gestalt.

[Translation done.]

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(71)出願人　000001007
キヤノン株式会社
東京都大田区下丸子3丁目30番2号

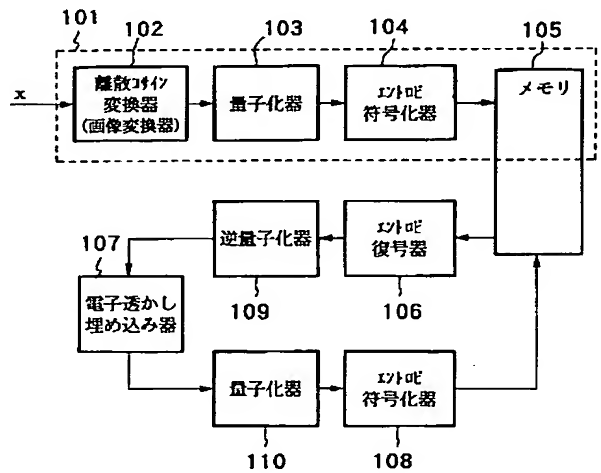
(72)発明者　岩村　惠市
東京都大田区下丸子3丁目30番2号　キヤノン株式会社内

(74)代理人　100076428
弁理士　大塚　康徳　（外2名）

最終頁に続く

(54)【発明の名称】　情報処理装置およびその方法、並びに、記憶媒体

(57)【要約】
【課題】　JPEG符号化を用いるディジタルカメラやカラーファクシミリなどの装置においては、ハードウェアにより入力画像を符号化圧縮データするので、圧縮符号化の前に電子透かしを埋め込む処理をするには多大なコスト増を招くことになる。
【解決手段】　符号化されたデータまたは量子化されたデータを入力し、入力データの符号化に用いられたテーブルまたは量子化に用いられたテーブルに基づき電子透かし情報を入力データに埋め込む。



【特許請求の範囲】
【請求項1】　量子化され符号化されたデータを一旦復号し逆量子化する復号手段と、
前記復号手段から出力されるデータに特定の情報を埋め込む埋込手段と、
前記埋込手段から出力されるデータを再び量子化し符号化する符号化手段とを有することを特徴とする情報処理装置。
【請求項2】　符号化されたデータを一旦復号する復号手段と、
前記復号手段から出力されるデータにデータに特定の情報を埋め込む埋込手段と、
前記埋込手段から出力されるデータを再び符号化する符号化手段とを有することを特徴とする情報処理装置。
【請求項3】　量子化され符号化されたデータを復号し逆量子化する復号手段と、
前記復号手段から出力されるデータに埋め込まれた特定の情報を抽出する抽出手段とを有することを特徴とする情報処理装置。
【請求項4】　符号化されたデータを復号する復号手段と、
前記復号手段から出力されるデータに埋め込まれた特定の情報を抽出する抽出手段とを有することを特徴とする情報処理装置。
【請求項5】　前記特定の情報とは電子透かし情報であることを特徴とする請求項1から請求項4の何れかに記載された情報処理装置。
【請求項6】　前記復号手段に入力されるデータは離散コサイン変換またはウェーブレット変換が施された画像データであることを特徴とする請求項1から請求項5の何れかに記載された情報処理装置。
【請求項7】　前記復号手段は、入力されるデータを所定の単位ごとに復号するか否かを選択することを特徴とする請求項1から請求項6の何れかに記載された情報処理装置。
【請求項8】　画像データを生成する生成手段と、
生成された画像データにデータ圧縮処理を施す圧縮手段と、
データ圧縮された画像データに特定の情報を埋め込む埋込手段とを有し、
前記圧縮手段と前記埋込手段とは独立に実行することが可能であることを特徴とする情報処理装置。
【請求項9】　前記特定の情報とは電子透かし情報であることを特徴とする請求項8に記載された情報処理装置。
【請求項10】　前記埋込手段の動作は、前記画像処理装置からデータが出力される場合に、または、前記生成手段が動作していない場合に行われることを特徴とする請求項8または請求項9に記載された情報処理装置。
【請求項11】　量子化され符号化されたデータを一旦復号して逆量子化し、
復号および逆量子化されたデータに特定の情報を埋め込み、
前記特定の情報が埋め込まれたデータを再び量子化し符号化することを特徴とする情報処理方法。
【請求項12】　符号化されたデータを一旦復号し、
復号されたデータに特定の情報を埋め込み、
前記特定の情報が埋め込まれたデータを再び符号化することを特徴とする情報処理方法。
【請求項13】　量子化され符号化されたデータを復号して逆量子化し、
逆量子化されたデータに埋め込まれた特定の情報を抽出することを特徴とする情報処理方法。
【請求項14】　符号化されたデータを復号し、
復号されたデータに埋め込まれた特定の情報を抽出することを特徴とする情報処理方法。
【請求項15】　前記特定の情報とは電子透かし情報であることを特徴とする請求項11から請求項14の何れかに記載された情報処理方法。
【請求項16】　画像データを生成し、生成された画像データにデータ圧縮処理を施し、データ圧縮された画像データに特定の情報を埋め込む画像処理方法であって、
前記圧縮ステップと前記埋込ステップとは独立に実行することが可能であることを特徴とする情報処理方法。
【請求項17】　前記特定の情報とは電子透かし情報であることを特徴とする請求項16に記載された情報処理方法。
【請求項18】　データに特定の情報を埋め込む情報処理のプログラムコードが記録された記憶媒体であって、
前記プログラムコードは少なくとも、
量子化され符号化されたデータを一旦復号して逆量子化するステップのコードと、
復号および逆量子化されたデータに特定の情報を埋め込むステップのコードと、
前記特定の情報が埋め込まれたデータを再び量子化し符号化するステップのコードとを有することを特徴とする記憶媒体。
【請求項19】　データに特定の情報を埋め込む情報処理のプログラムコードが記録された記憶媒体であって、
前記プログラムコードは少なくとも、
符号化されたデータを一旦復号するステップのコードと、
復号されたデータに特定の情報を埋め込むステップのコードと、
前記特定の情報が埋め込まれたデータを再び符号化するステップのコードとを有することを特徴とする記憶媒体。
【請求項20】　データに埋め込まれた特定の情報を抽出する情報処理のプログラムコードが記録された記憶媒体であって、前記プログラムコードは少なくとも、

量子化され符号化されたデータを復号して逆量子化するステップのコードと、
逆量子化されたデータに埋め込まれた特定の情報を抽出するステップのコードとを有することを特徴とする記憶媒体。
【請求項21】　データに埋め込まれた特定の情報を抽出する情報処理のプログラムコードが記録された記憶媒体であって、前記プログラムコードは少なくとも、
符号化されたデータを復号するステップのコードと、
復号されたデータに埋め込まれた特定の情報を抽出するステップのコードとを有することを特徴とする記憶媒体。
【請求項22】　画像データを生成し、生成された画像データにデータ圧縮処理を施し、データ圧縮された画像データに特定の情報を埋め込む画像処理のプログラムコードが記録された記憶媒体であって、
前記圧縮ステップのコードと前記埋込ステップのコードとは独立に実行されることが可能であることを特徴とする記憶媒体。
【請求項23】　前記特定の情報とは電子透かし情報であることを特徴とする請求項18から請求項22の何れかに記載された記憶媒体。
【発明の詳細な説明】
【0001】
【発明の属する技術分野】本発明は情報処理装置およびその方法、並びに、記憶媒体に関し、例えば、符号化または量子化されたデータに電子透かし情報のような特定な情報を埋め込む情報処理装置およびその方法、並びに、記憶媒体に関するものである。
【0002】
【従来の技術】近年のコンピュータおよびネットワークの発達は著しく、文字、画像、音声など様々な情報、所謂マルチメディア情報がコンピュータで、ネットワークを介して扱われている。画像や音声のデータは比較的データ量が大きいため、画像や音声のデータは符号化圧縮することで、そのデータ量を小さくする処理が行われる。画像データを圧縮すれば、より多くの画像情報をネットワークを介して高速に伝送することができる。画像圧縮技術としては、ITU-T勧告T.81における多値静止画像を圧縮する通称JPEG方式が普及しているが、さらに高性能の圧縮を目指してJPEG2000の標準化が検討されている。
【0003】JPEGは離散コサイン変換(DCT)を用いる符号化方式が基本であるが、JPEG2000は離散ウェーブレット変換を用いる方式が有力である。JPEGおよびJPEG2000の符号化装置は一般に、図1Aに示すように、離散コサイン変換や離散ウェーブレット変換を行う周波数変換器701、量子化器702およびエントロピ符号化器703などから構成される。一方、JPEGおよびJPEG2000の伸長装置は、図1Bに示すように、エントロピ復号器704、逆量子化器705および逆周波数変換器706などから構成される。
【0004】ところで、コンピュータやネットワークで利用される画像や音声はディジタル化されたデータであるため、それらのデータを容易に複製できる環境にあり、複製によってもデータの質が劣化することはない。このため、これらマルチメディア情報の著作権を保護するために、画像や音声のデータに著作権情報を電子透かしとして埋め込む処理が施される。電子透かしをマルチメディアデータから抽出することにより著作権情報を得て、不正な複製を防止することが可能である。
【0005】電子透かしを埋め込む方法としては、例えば、離散コサイン変換を利用するNTT方式「ディジタル画像の著作権保護のための周波数領域における電子透かし方式」（中村、小川、高嶋、SCIS'97-26A、1997年1月）、離散フーリエ変換を利用する防衛大方式「PN系列による画像への透かし署名法」（大西、岡、松井、SCIS'97-26B、1997年1月）、離散ウェーブレット変換を利用する三菱、九大方式「ウェーブレット変換を用いた電子透かし技術の安全性と信頼性に関する実験的考察」（石塚、坂井、櫻井、SCIS'97-26D、1997年1月）などが挙げられる。
【0006】これらの電子透かし埋め込み装置は一般的に、図2Aに示すように、離散コサイン変換や離散ウェーブレット変換を行う周波数変換器801、その周波数成分を埋め込む情報に応じて量子化する電子透かし埋め込み器802、および、逆周波数変換器803から構成される。一方、電子透かし抽出装置は図2Bに示すように、周波数変換器804、および、量子化された周波数成分から埋め込まれた情報を抽出する電子透かし抽出器805から構成される。
【0007】
【発明が解決しようとする課題】画像データに電子透かし埋め込み処理と圧縮処理とを施す場合、電子透かしが埋め込まれた画像データを圧縮することは容易である。しかし、圧縮されたデータに電子透かしを埋め込むことは困難である。圧縮処理されたデータは、エントロピ符号化された符号データであるから、それに電子透かしを直接埋め込むことは困難である。
【0008】圧縮されたデータに電子透かしを埋め込むには、図3に示すように、画像変換器902からエントロピ符号化器904によって圧縮された画像データxを、エントロピ復号器905から画像逆変換器907により伸長して、一旦画像データに戻した後、画像変換器908から画像逆変換器910により電子透かしを埋め込み、さらに、その出力を画像変換器911からエントロピ符号化器913により再圧縮することになる。
【0009】これに対して、電子透かし埋め込み処理の出力は、画像データそのものであるから、そのまま圧縮処理へ入力することができる。
【0010】しかし、JPEGなどの符号化を用いるディジ

タルカメラやカラーファクシミリなどの装置、静止画伝送システム、静止画処理システムなど数々のアプリケーションや装置が実用化されている。これらアプリケーションや装置においては、ASICなどのハードウェアを用いて、入力画像をまず符号化する、すなわち圧縮データにする場合が多い。従って、これらアプリケーションや装置において、圧縮符号化の前に電子透かしを埋め込むようにするには多大なコスト増を招くことになる。

【0011】また、現在検討中のJPEG2000においても、圧縮符号化と電子透かしとの一体化については充分に検討されていないので、JPEGの場合と同様、電子透かしを埋め込むのが難しいという問題が生じる可能性が高い。

【0012】本発明は、上述の問題を解決するためのものであり、符号化または量子化されたデータに、電子透かし情報のような特定の情報を埋め込む情報処理装置およびその方法を提供することを目的とする。

【0013】

【課題を解決するための手段】本発明は、前記の目的を達成する一手段として、以下の構成を備える。

【0014】本発明にかかる情報処理装置は、量子化され符号化されたデータを一旦復号し逆量子化する復号手段と、前記復号手段から出力されるデータに特定の情報を埋め込む埋込手段と、前記埋込手段から出力されるデータを再び量子化し符号化する符号化手段とを有することを特徴とする。

【0015】また、符号化されたデータを一旦復号する復号手段と、前記復号手段から出力されるデータにデータに特定の情報を埋め込む埋込手段と、前記埋込手段から出力されるデータを再び符号化する符号化手段とを有することを特徴とする。

【0016】また、量子化され符号化されたデータを復号し逆量子化する復号手段と、前記復号手段から出力されるデータに埋め込まれた特定の情報を抽出する抽出手段とを有することを特徴とする。

【0017】また、符号化されたデータを復号する復号手段と、前記復号手段から出力されるデータに埋め込まれた特定の情報を抽出する抽出手段とを有することを特徴とする。

【0018】本発明にかかる情報処理方法は、量子化され符号化されたデータを一旦復号して逆量子化し、復号および逆量子化されたデータに特定の情報を埋め込み、前記特定の情報が埋め込まれたデータを再び量子化し符号化することを特徴とする。

【0019】また、符号化されたデータを一旦復号し、復号されたデータに特定の情報を埋め込み、前記特定の情報が埋め込まれたデータを再び符号化することを特徴とする。

【0020】また、量子化され符号化されたデータを復号して逆量子化し、逆量子化されたデータに埋め込まれた特定の情報を抽出することを特徴とする。

【0021】また、符号化されたデータを復号し、復号されたデータに埋め込まれた特定の情報を抽出することを特徴とする。

【0022】

【発明の実施の形態】以下、本発明にかかる一実施形態の情報処理装置である画像処理装置を図面を参照して詳細に説明する。なお、本発明は、ディジタル画像データに圧縮処理、および、電子透かしの埋め込み処理を施すことにより、著作権の保護、画像の改竄防止、各種情報記録などを行う情報処理装置およびその方法に関するものである。

【0023】

【第1実施形態】図4は第1実施形態の画像処理装置の概略構成を示すブロック図である。まず、処理の流れを簡単に説明する。

【0024】図4において、入力される画像データxは一画素あたり所定のビット数をもつ多値画像データである。入力される多値画像データには、離散コサイン変換器102により所定の変換処理が施され、所定の周波数成分に分解される。入力画像データの画素は互いに重ならないブロックに分解され、そのブロック単位で離散コサイン変換が行われる。離散コサイン変換は次式を用いて実行することが可能である。

$$Xi(u,v) = 2/N\cdot C(u)C(v)\Sigma u\Sigma v xi(m,n) \cdot\cos[\{(2m+1)u\pi\}/(2N)] \cdot\cos[\{(2n+1)v\pi\}/(2N)] \quad \cdots(1)$$

ただし、$p = 0$のとき$C(p) = 1/\sqrt{2}$

$p \neq 0$のとき$c(p) = 1$

【0025】自然画像の画像データは、低周波成分の信号を多く含むため、離散コサイン変換を施すことにより、低周波領域に信号を偏らせることが可能である。離散コサイン変換器102から出力される変換係数（以下「DCT係数」と呼ぶ）は量子化器103に入力される。

【0026】前述したように、自然画像の画像データは低周波成分の信号を多く含むから、量子化により、画像データの低周波成分により多くのビットを割り当て、高周波成分により少ないビットを割り当てるようにすれば、画像データを効率的に圧縮することが可能である。

【0027】量子化された画像データは、例えばハフマン符号化などを実行するエントロピ符号化器104に入力され、出現確率の低い情報には長い符号語が、出現確率の高い情報には短い符号語が割り当てられ、その結果、平均符号語長が短縮される。エントロピ符号化された圧縮画像データは、磁気記憶装置などのメモリ105に入力される。

【0028】以下では、メモリ105に記憶された圧縮画像データに電子透かしを埋め込む処理を説明する。

【0029】メモリ105から読み出されたエントロピ符号化された圧縮画像データを、圧縮時に用いられたエントロピ符号化器104に対応するエントロピ復号器106で復

号して、量子化データを得る。この量子化データは、圧縮時に用いられた量子化器103に対応する逆量子化器109により逆量子化されて、DCT係数に戻される。そして、電子透かし埋め込み器107により、DCT係数に電子透かしが埋め込まれる。つまり、電子透かし埋め込み器107は、DCT係数を操作することにより、電子透かしが埋め込まれたDCT係数を出力するものである。

【００３０】電子透かしが埋め込まれたDCT係数は、量子化器110およびエントロピ符号化器108により再び圧縮処理され、エントロピ符号化器108の出力は再びメモリ105に記憶される。

【００３１】離散コサイン変換を利用した電子透かしの埋め込み方式には、次のような方式が挙げられる。

【００３２】入力画像を8×8画素の正方ブロックに分割し、離散コサイン変換により得られたDCT係数を電子透かし埋め込み器107へ入力する。そして、一つのブロックの中から一つのDCT係数を選択し、選択されたDCT係数に電子透かし情報を表すビット（以下「埋込ビット」と呼ぶ）を埋め込む。なお、埋込ビットを埋め込む周波数成分は、直流成分を除く比較的低周波の成分からランダムに選択される。

【００３３】そして、埋込ビットが埋め込まれたDCT係数を量子化することによって電子透かしの埋め込みが完了する。このときの、量子化ステップの大きさが埋め込みの強度に対応する。

【００３４】電子透かしを埋め込むためのビット（以下「埋め込みビット」と呼ぶ）‘0’または‘1’を埋め込む例を以下に示す。まず、式(2)によりs_{u_0 v_0}を量子化した値qを得る。

q = <;<;s_{u_0 v_0}/h>;>;h　　…(2)

ただし、s_{u_0 v_0}はDCT係数の値

hは埋め込み強度

<;<;x>;>;はxを超えない最大の整数

【００３５】そして、式(3)または式(4)から得られるcのうち、最もs_{u_0 v_0}に近いcを電子透かし埋め込み後のDCT係数にする。

埋込ビット‘0’のとき　c = q + ht + q/4　　…(3)

埋込ビット‘1’のとき　c = q + ht + 3q/4　　…(4)

ただし、tは自然数

【００３６】上記の電子透かし埋め込み例においては、埋め込み成分を特定するための乱数を発生する乱数発生器へ設定する初期値と、量子化ステップの値とが鍵になる。

【００３７】上記では、画像データの圧縮処理から電子透かしの埋め込み処理までが一体化された装置を説明したが、通常、離散コサイン変換器102からメモリ105までの処理は画像圧縮装置101として一体化されている場合が多い。従って、メモリ105に記憶された圧縮画像データに電子透かしを埋め込む場合、図4に示すエントロピ復号器106からエントロピ符号化器110による処理を加えるだけで、電子透かしの埋め込み処理が実現され効率的である。

【００３８】また、画像データの圧縮処理と電子透かしの埋め込み処理とを連続に行う場合は、圧縮画像データをメモリ105に入力せずに直接エントロピ復号器106に入力することもできる。また、エントロピ符号化器108の出力をメモリ105に入力せずに、画像処理装置101の出力とすることもてきる。

【００３９】また、メモリ105を用いる場合、電子透かしの埋め込み処理は、画像データの圧縮処理とは独立に行うことができるので、画像処理装置から圧縮画像データを出力する際に電子透かしの埋め込み処理を行う、または、画像データの圧縮処理が行われていないとき、すなわち画像データxが入力されていないときに行う、などの使用法が考えられる。

【００４０】さらに、電子透かしの埋め込みを必要としない場合は、メモリ105からエントロピ復号器106へ圧縮画像データが出力されないようにメモリ105を制御すればよい。

【００４１】

【第2実施形態】以下、本発明にかかる第2実施形態の画像処理装置を説明する。なお、本実施形態において、第1実施形態と略同様の構成については、同一符号を付して、その詳細な説明を省略する。

【００４２】第1実施形態において説明した電子透かしの埋め込み手法は、式(2)の<;<;s_{u_0v_0}>;>;においてDCT係数s_{u_0 v_0}をパラメータhにより量子化するものである。この量子化は、データ圧縮処理における量子化とは異なるため、第1実施形態においては、エントロピ復号器106および逆量子化器109を用いて圧縮画像データをDCT係数に戻す必要がある。

【００４３】ここで、電子透かしの埋め込み処理に用いられる量子化が、データ圧縮処理で用いられる量子化と同じであるか、データ圧縮処理で用いられる量子化を考慮した処理である場合、逆量子化器109を必要とせずに、量子化データに電子透かしを埋め込むことができる。

【００４４】図5は逆量子化器109を必要としない画像処理装置の構成例を示すブロック図である。

【００４５】例えば、式(2)におけるパラメータhを、データ圧縮で用いられる量子化ステップの値と同じにすれば、エントロピ復号された量子化データは<;<;s_{u_0 v_0}/h>;>;と等価であるから、それを用いて式(2)のqを計算することができ、電子透かしを埋め込むことができるのは明らかである。

【００４６】上記では、データ圧縮処理と電子透かしの埋め込み処理とに用いられる量子化が同じ場合について説明した。一方、電子透かしの埋め込み処理に用いられる量子化が、圧縮処理に用いられる量子化を考慮している場合、すなわち二つの量子化ステップの値が何らかの

関係をもつ場合は、エントロピ復号された量子化データを電子透かしの埋め込み処理に必要な量子化データに変換することができる。従って、電子透かしの埋め込み処理に用いられる量子化が、圧縮処理に用いられる量子化を考慮している場合も、図2に示すように、逆量子化器109なしで圧縮画像データに電子透かしを埋め込むことができるのは明らかである。

【0047】

【第3実施形態】以下、本発明にかかる第3実施形態の画像処理装置を説明する。なお、本実施形態において、第1実施形態と略同様の構成については、同一符号を付して、その詳細な説明を省略する。

【0048】上述の実施形態においては、離散コサイン変換を用いた電子透かしの埋め込みを説明したが、本発明は、離散コサイン変換以外の種々の画像変換を利用して電子透かしを埋め込むことができる。例えば、JPEG2000においては、画像変換として離散ウェーブレット変換が有力であるが、全体的な圧縮/伸長手順は図1Aおよび1Bに示す構成で行われる予定であるから、本発明は、JPEG2000に対しても有効である。他の画像変換としては、さらに離散フーリエ変換および予測符号化を含む種々の変換が挙げられるが、それらの変換データが量子化やエントロピ符号化によってデータ圧縮される場合、本発明による電子透かしの埋め込み処理は有効である。

【0049】また、第1および第2実施形態に示した電子透かしの埋め込み例に限らず、データ圧縮と電子透かしの埋め込みとで同一の画像変換を用いる場合には、種々の埋め込み手法が電子透かし埋め込み器107で利用できる。

【0050】また、第1および第2実施形態では、電子透かしを埋め込む対象を画像データとして説明したが、本発明は画像データに限らず、音声を含むサウンドデータなどに種々のデータ圧縮を施し、電子透かしを埋め込む場合にも適用することができる。

【0051】また、第1および第2実施形態に示した電子透かしの埋め込みブロックを、図6Aおよび図6Bに示すように、独立させて装置にすることもできる。

【0052】図7に示すように、量子化器103の前にスイッチ111を設けて、量子化器103へ入力されるDCT係数を、画像変換器102または電子透かし埋め込み器107の何れかの出力から選択することもできる。このようにすれば、第1および第2実施形態において、エントロピ符号化器104および量子化器103を画像データの圧縮処理および電子透かしの埋め込み処理で共有することが可能であり、さらに効率的な装置を実現することができる。

【0053】また、画像圧縮ブロックと画像伸長ブロックとを備える画像処理装置においては、図8に示すように、画像伸長用の逆量子化器109の出力を電子透かし埋め込み器107へ導き、さらに、量子化器103の前にスイッチ111を設けることにより、エントロピ符号化器104および量子化器103だけでなく、伸長処理用のエントロピ復号器106および逆量子化器109を電子透かしの埋め込み処理で共有することが可能であり、さらに効率的な装置を実現することができる。なお、画像逆変換器112は、画像変換器102と逆の処理を行うものである。

【0054】

【第4実施形態】以下、本発明にかかる第4実施形態の画像処理装置を説明する。なお、本実施形態において、上記の各実施形態と略同様の構成については、同一符号を付して、その詳細な説明を省略する。

【0055】図9および図10は電子透かしが埋め込まれた圧縮データから電子透かしを抽出する装置の構成例を示すブロック図で、図9は図6Aに示す電子透かしの埋め込み装置に対応する構成例、図10は図6Bに示す電子透かしの埋め込み装置に対応する逆量子化器を必要としない構成例である。

【0056】図9および図10に示す装置へ入力されるデータは、電子透かしが埋め込まれた圧縮データである。入力される圧縮データは、電子透かしの埋め込みに用いられたエントロピ符号化器108に対応するエントロピ復号器501によって量子化データに変換される。得られた量子化データは、図9に示す構成では電子透かしの埋め込みに用いられた量子化器110に対応する逆量子化器502によりDCT係数などの画像変換方法に依存する係数に変換された後、電子透かし抽出器503へ入力される。図10に示す構成では、量子化データが電子透かし抽出器503へ入力される。

【0057】電子透かし抽出器503は、電子透かしの埋め込みに対応する抽出処理により埋め込まれた電子透かし情報を抽出する。この電子透かしの抽出処理は、第1および第2実施形態で説明した離散コサイン変換を用いる電子透かしの埋め込み処理や、第3実施形態で説明した種々の画像変換を用いる電子透かしの埋め込み処理に対応する手法であればよい。

【0058】上述した各実施形態の画像処理装置は、ディジタルカメラのような画像入力装置に適用できる。その場合、それら画像入力装置における画像圧縮処理がハードウェア化されているとしても、CPUにプログラムを供給することで電子透かし埋め込み処理を実現すれば、新たなハードウェアを付加せずに容易に電子透かし埋め込み処理が実現できる。さらに、電子透かし埋め込み処理は、データ圧縮処理とは異なり、必ずしもリアルタイム処理を要求されないので、ディジタルカメラなどの画像入力装置からパーソナルコンピュータなどへデータを転送するときや、画像入力装置が画像入力を実行していないときに電子透かしの埋め込み処理を実行することができる。そうすれば、画像入力装置に搭載されたCPUの処理能力が小さい場合でも短時間に電子透かしの埋め込みを行うことが可能である。

【0059】また、上述した各実施形態の画像処理装置

は、カラーファクシミリ装置のような画像入出力装置にも適用できることは明らかである。その場合、画像入力装置によって埋め込まれた電子透かしは、第4実施形態に示した電子透かし抽出機能を画像出力装置に組み込むことにより、埋め込まれた電子透かし情報が抽出される。この際、埋め込まれた電子透かし情報により画像出力に対する規制情報が示される場合、その規制情報に応じて画像出力装置を制御することも可能である。

【００６０】また、上述した各実施形態は、JPEGなどの圧縮アプリケーションをもつ静止画伝送システムおよび静止画処理システムなど、数々のシステムに適用することができることは明らかである。

【００６１】以上説明したように、上述した各実施形態によれば、画像圧縮機能を有する画像処理装置に簡単な処理手段を追加することにより、圧縮されたデータへ電子透かし情報を埋め込み、および、電子透かし情報を抽出することができる。

【００６２】

【他の実施形態】なお、本発明は、複数の機器（例えばホストコンピュータ、インタフェイス機器、リーダ、プリンタなど）から構成されるシステムに適用しても、一つの機器からなる装置（例えば、複写機、ファクシミリ装置など）に適用してもよい。

【００６３】また、本発明の目的は、前述した実施形態の機能を実現するソフトウェアのプログラムコードを記録した記憶媒体を、システムあるいは装置に供給し、そのシステムあるいは装置のコンピュータ（またはCPUやMPU）が記憶媒体に格納されたプログラムコードを読出し実行することによっても、達成されることは言うまでもない。この場合、記憶媒体から読出されたプログラムコード自体が前述した実施形態の機能を実現することになり、そのプログラムコードを記憶した記憶媒体は本発明を構成することになる。また、コンピュータが読出したプログラムコードを実行することにより、前述した実施形態の機能が実現されるだけでなく、そのプログラムコードの指示に基づき、コンピュータ上で稼働しているOS（オペレーティングシステム）などが実際の処理の一部または全部を行い、その処理によって前述した実施形態の機能が実現される場合も含まれることは言うまでもない。

【００６４】さらに、記憶媒体から読出されたプログラムコードが、コンピュータに挿入された機能拡張カードやコンピュータに接続された機能拡張ユニットに備わるメモリに書込まれた後、そのプログラムコードの指示に基づき、その機能拡張カードや機能拡張ユニットに備わるCPUなどが実際の処理の一部または全部を行い、その処理によって前述した実施形態の機能が実現される場合も含まれることは言うまでもない。

【００６５】

【発明の効果】以上説明したように、本発明によれば、符号化または量子化されたデータに、電子透かし情報のような特定の情報を埋め込む情報処理装置およびその方法を提供することができる。

【図面の簡単な説明】

【図１Ａ】画像符号化装置の概要を説明するブロック図、

【図１Ｂ】画像復号装置の概要を説明するブロック図、

【図２Ａ】電子透かし埋め込み装置の概要を説明するブロック図、

【図２Ｂ】電子透かし抽出装置の概要を説明するブロック図、

【図３】圧縮データに電子透かしを埋め込む装置の概要を説明するブロック図、

【図４】第1実施形態の画像処理装置の構成例を示すブロック図、

【図５】第2実施形態の画像処理装置の構成例を示すブロック図、

【図６Ａ】第3実施形態の画像処理装置の構成例を示すブロック図、

【図６Ｂ】第3実施形態の画像処理装置の第二例を示すブロック図、

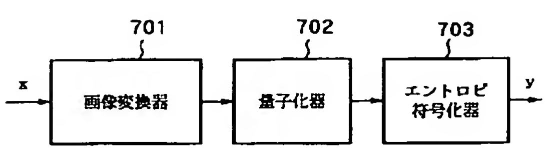
【図７】第3実施形態の画像処理装置の第三例を示すブロック図、

【図８】第3実施形態の画像処理装置の第四例を示すブロック図、

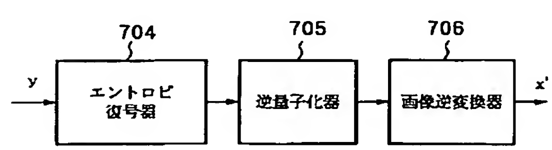
【図９】第4実施形態の画像処理装置の構成例を示すブロック図、

【図１０】第4実施形態の画像処理装置の第二例を示すブロック図である。

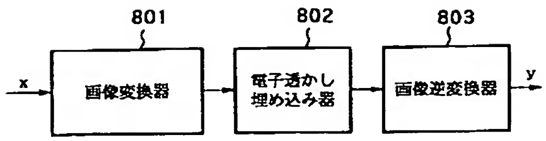
【図１Ａ】



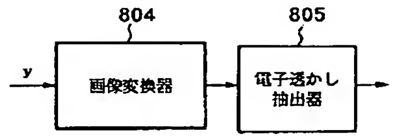
【図１Ｂ】



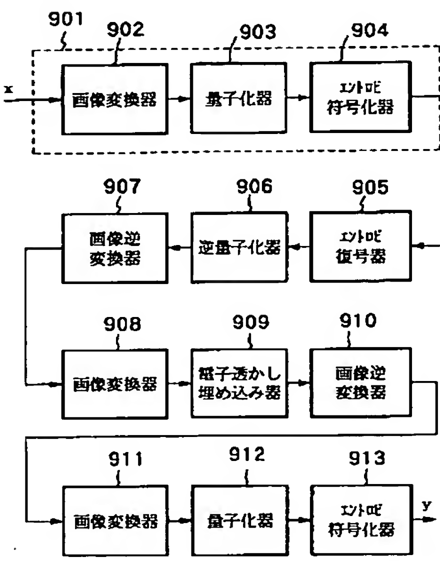
【図2A】



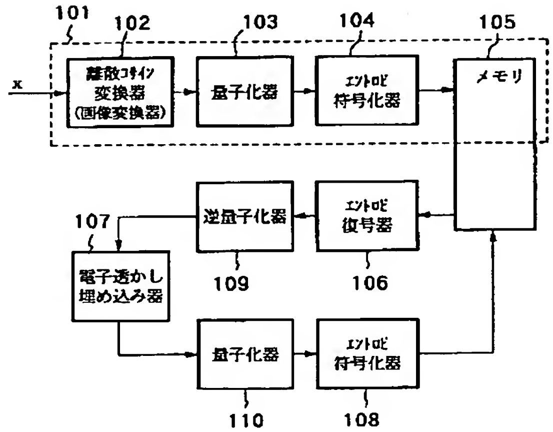
【図2B】



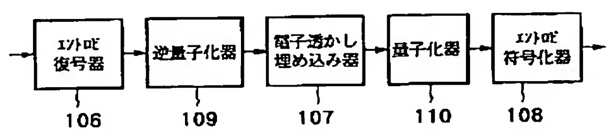
【図3】



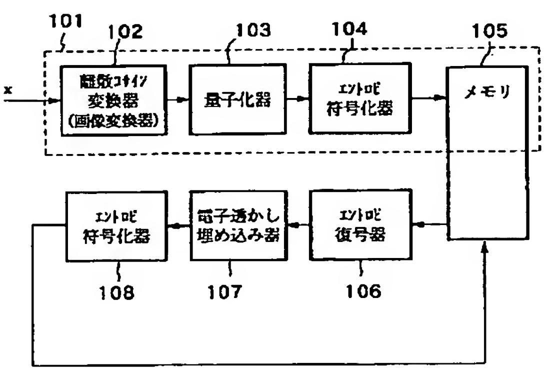
【図4】



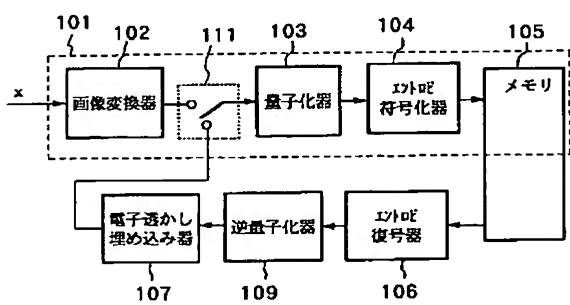
【図6A】



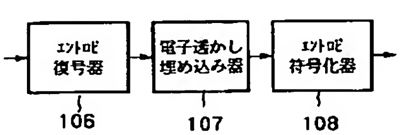
【図5】



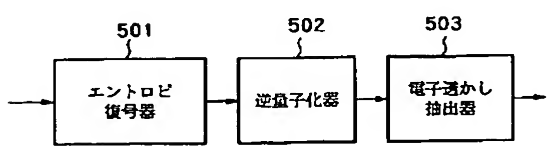
【図7】



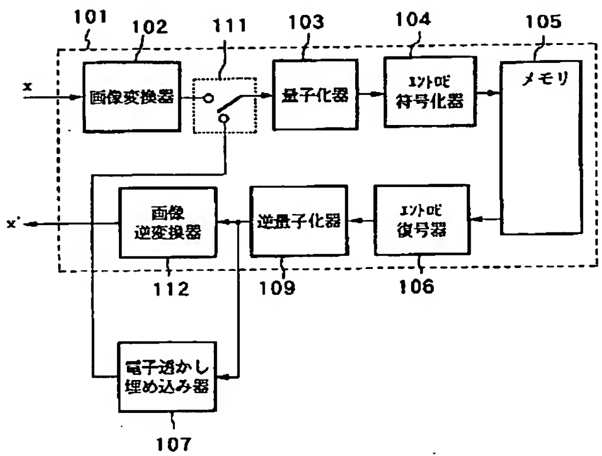
【図6B】



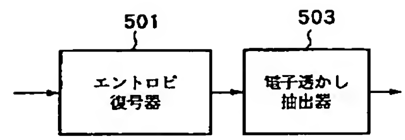
【図9】



【図8】



【図10】



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